

## ABSTRACT

An antenna portion (7) includes a radial waveguide (7a) made of metal and connected to a lower end of a waveguide pipe (19), and a slot antenna (7b). A top plate (5) is arranged above a chamber (1). A layer (20) of air is formed between the antenna portion (7) and the top plate (5). Half a difference between an inner diameter B of a region, in which the top plate (5) and the antenna portion (7) are present, and an inner diameter A of the radial waveguide (7a) is equal to a product of a wave length  $\lambda_g$  of the microwave, which is based on a composite dielectric constant resulting from a dielectric constant of the top plate (5) and a dielectric constant of an atmosphere (air layer (20)) in the region containing the top plate (5) and the antenna portion (7), and zero or a natural number. An inner diameter C of the chamber (1) is equal to or shorter than the inner diameter A of the radial waveguide (7a). Thereby, the electromagnetic field for forming the plasma production region (17) is controlled to achieve a uniform plasma density.